Practitioner's Docket No. 297-010894-US(PAR)

CHAPTER II 10/089426

JC05 Rec'd PCT/PTO 29 MAR 2002

Preliminary Classification:
Proposed Class:
Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.'" M.P.E.P., § 601, 7th ed.

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US) (ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FI00/00848	2 October 2000	1 October 1999

TITLE OF INVENTION

A RADIO LINK SYSTEM

APPLICANT(S)

Juha PIHLAJA

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: EO/US

CERTIFICATION UNDER 37 C.F.R. §§ 1.8(a) and 1.10*
(When using Express Mail, the Express Mail label number is mandatory; Express Mail certification is optional.)

I hereby certify that, on the date shown below, this correspondence is being:

MAILING

☒ deposited with the United States Postal Service in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231

37 C.F.R. § 1.8(a)

☐ with sufficient postage as first class mail.

37 C.F.R. § 1.10 *

☒ as "Express Mail Post Office to Addressee"
Mailing Label No. EL627432709US **(mandatory)**

TRANSMISSION

☐ facsimile transmitted to the Patent and Trademark Office, (703) _____

Debra G. Conrad
Signature

Date: March 29, 2002

Debra G. Conrad
(type or print name of person certifying)

** Only the date of filing (§ 1.6) will be the date used in a patent term adjustment calculation, although the date on any certificate of mailing or transmission under § 1.8 continues to be taken into account in determining timeliness. See § 1.703(f). Consider "Express Mail Post Office to Addressee" (§ 1.10) or facsimile transmission (§ 1.6(d)) for the reply to be accorded the earliest possible filing date for patent term adjustment calculations.*

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

***WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing—See 37 C.F.R. § 1.8.*

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).

b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☐*	TOTAL CLAIMS 7	7 −20=	0	× $18.00=	$ 0
	INDEPENDENT CLAIMS 4	4 −3=	1	× $84.00 =	84.00
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+$ 280.00 =	
BASIC FEE**	☐ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an international preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☐ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 C.F.R. § 1.492(a)(4)) ..... $100.00 ☐ and the above requirements are not met (37 C.F.R. § 1.492(a)(1)) ..... $ 710.00 ☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☒ has been paid (37 C.F.R. § 1.492(a)(2)) ..... $ 740.00 ☐ has not been paid (37 C.F.R. § 1.492(a)(3)) .. $1,040.00 ☐ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 C.F.R. § 1.492(a)(5)) ..... $ 890.00				740.00
	Total of above Calculations				= 824.00
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Assertion must be made. (note 37 C.F.R. § 1.27)				−
	Subtotal				824.00
	Total National Fee				$ 824.00
	Fee for recording the enclosed assignment document $40.00 (37 C.F.R. § 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				40.00
TOTAL	Total Fees enclosed				$ 864.00

*See attached Preliminary Amendment Reducing the Number of Claims.

☒ Attached is a ☒ check ☐ money order in the amount of $ 864.00

☐ Authorization is hereby made to charge the amount of $ _____

☒ to Deposit Account No. 16-1350

☐ to Credit card as shown on the attached credit card information authorization form PTO-2038.

WARNING: *Credit card information should* ***not*** *be included on this form as it may become public.*

☒ Charge any additional fees required by this paper or credit any overpayment in the manner authorized above.

A duplicate of this paper is attached.

"WARNING: *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

☐ **Assertion of Small Entity Status**

☐ **Applicant hereby asserts status as a small entity under 37 C.F.R. § 1.27.**

NOTE: 37 C.F.R. § 1.27(c) deals with the assertion of small entity status, whether by a written specific declaration thereof or by payment as a small entity of the basic filing fee or the fee for the entry into the national phase as states:

"(c) Assertion of small entity status. Any party (person, small business concern or nonprofit organization) should make a determination, pursuant to paragraph (f) of this section, of entitlement to be accorded small entity status based on the definitions set forth in paragraph (a) of this section, and must, in order to establish small entity status for the purpose of paying small entity fees, actually make an assertion of entitlement to small entity status, in the manner set forth in paragraphs (c)(1) or (c)(3) of this section, in the application or patent in which such small entity fees are to be paid.

(1) Assertion by writing. Small entity status may be established by a written assertion of entitlement to small entity status. A written assertion must:

(i) Be clearly identifiable;

(ii) Be signed (see paragraph (c)(2) of this section); and

(iii) Convey the concept of entitlement to small entity status, such as by stating that applicant is a small entity, or that small entity status is entitled to be asserted for the application or patent. While no specific words or wording are required to assert small entity status, the intent to assert small entity status must be clearly indicated in order to comply with the assertion requirement.

(2) Parties who can sign and file the written assertion. The written assertion can be signed by:

(i) One of the parties identified in §§ 1.33(b) (e.g., an attorney or agent registered with the Office), §§ 3.73(b) of this chapter notwithstanding, who can also file the written assertion;

(ii) At least one of the individuals identified as an inventor (even though a §§ 1.63 executed oath or declaration has not been submitted), notwithstanding §§ 1.33(b)(4), who can also file the written assertion pursuant to the exception under §§ 1.33(b) of this part; or

(iii) An assignee of an undivided part interest, notwithstanding §§ 1.33(b)(3) and 3.73(b) of this chapter, but the partial assignee cannot file the assertion without resort to a party identified under §§ 1.33(b) of this part.

(3) Assertion by payment of the small entity basic filing or basic national fee. The payment, by any party, of the exact amount of one of the small entity basic filing fees set forth in §§ 1.16(a), (f), (g), (h), or (k), or one of the small entity basic national fees set forth in §§ 1.492(a)(1), (a)(2), (a)(3), (a)(4), or (a)(5), will be treated as a written assertion of entitlement to small entity status even if the type of basic filing or basic national fee is inadvertently selected in error.

(i) If the Office accords small entity status based on payment of a small entity basic filing or basic national fee under paragraph (c)(3) of this section that is not applicable to that application, any balance of the small entity fee that is applicable to that application will be due along with the appropriate surcharge set forth in §§ 1.16(e), or §§ 1.16(l).

(ii) The payment of any small entity fee other than those set forth in paragraph (c)(3) of this section (whether in the exact fee amount or not) will not be treated as a written assertion of entitlement to small entity status and will not be sufficient to establish small entity status in an application or a patent."

3. [XX] A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: *Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.*

a. ☐ is transmitted herewith.

b. ☐ is not required, as the application was filed with the United States Receiving Office.

c. [XX] has been transmitted

i. [XX] by the International Bureau.

Date of mailing of the application (from form PCT/1B/308):

4/12/01

ii. ☐ by applicant on _____. *(Date)*

4. [X] A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

a. ☐ is transmitted herewith.

b. [XX] is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on _____. *(Date)*

d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

a. ☐ are transmitted herewith.

b. ☐ have been transmitted

i. ☐ by the International Bureau.

Date of mailing of the amendment (from form PCT/1B/308):

_____.

ii. ☐ by applicant on _____. *(Date)*

c. ☒ have not been transmitted as

i. ☒ applicant chose not to make amendments under PCT Article 19. Date of mailing of Search Report (from form PCT/ISA/210.):
1/23/01
_____.

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☐ is not required as the amendments were made in the English language.

c. ☒ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☒ is transmitted herewith.

☐ is not required as the application was filed with the United States Receiving Office.

8. ☐ Annex(es) to the International preliminary examination report

a. ☐ is/are transmitted herewith.

b. ☐ is/are not required as the application was filed with the United States Receiving Office.

9. ☐ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☐ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

a. ☐ was previously submitted by applicant on _____. *(Date)*

b. ☒ is submitted herewith, and such oath or declaration

i. ☒ is attached to the application.

ii. ☒ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.

c. ☐ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

a. ☒ is transmitted herewith.

b. ☐ has been transmitted by the International Bureau.

Date of mailing (from form PCT/IB/308): _____.

c. ☐ is not required, as the application was searched by the United States International Searching Authority.

d. ☐ will be transmitted promptly upon request.

e. ☐ has been submitted by applicant on _____. *(Date)*

12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

a. ☐ is transmitted herewith.

Also transmitted herewith is/are:

☐ Form PTO-1449 (PTO/SB/08A and 08B).

☐ Copies of citations listed.

b. ☒ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).

c. ☐ was previously submitted by applicant on _____. *(Date)*

13. ☒ An assignment document is transmitted herewith for recording.

A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

_____

_____

_____

14. ☒ Additional documents:

a. ☒ Copy of request (PCT/RO/101)

b. ☒ International Publication No. WO 01/26253 A1

i. ☒ Specification, claims and drawing

ii. ☐ Front page only

c. ☒ Preliminary amendment (37 C.F.R. § 1.121)

d. ☒ Other

PCT/IB/308; Written Opinion; PCT/IB/304; PCT/IB/306

15. ☒ The above checked items are being transmitted

a. ☒ before 30 months from any claimed priority date.

b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ Please charge, in the manner authorized above, the following additional fees that may be required by this paper and during the entire pendency of this application:

☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☒ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 C.F.R. § 1.17 (application processing fees)

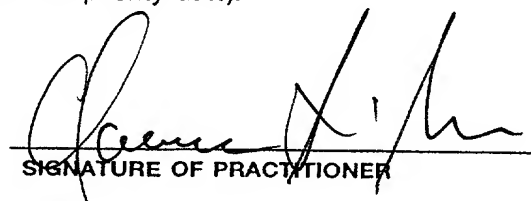
☒ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).



SIGNATURE OF PRACTITIONER

Reg. No.: 24,622

Clarence A. Green

(*type or print name of practitioner*)

Tel. No.: (203 ..) 259-1800

PERMAN & GREEN, LLP

P.O. Address

Customer No.: 2512

425 Post Road, Fairfield, CT 06430 USA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Express Mail No.: EL627432709US
Applicant: Juha PIHLAJA
INTERNATIONAL APPLICATION NO.: PCT/FI00/00848
INTERNATIONAL FILING DATE: 10/2/00
U.S. SERIAL NUMBER:
TITLE: A RADIO LINK SYSTEM
ATTORNEY DOCKET NO.: 297-010894-US(PAR)

Box PCT
Commissioner of Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the above-identified, patent application as follows:

IN THE SPECIFICATION:

After the Title and before the first paragraph, please insert the following new paragraph:

--This application claims the benefit of the earlier filed International Application No. PCT/FI00/00848, International Filing Date, 2 October 2000, which designated the United States of America, and which international application was published under PCT Article 21(2) in English as WO Publication No. WO 01/26253 A1.--

On page 12, after the heading "Claims", please insert the following;

--What is claimed is:--

IN THE CLAIMS

Please amend Claims 1, 3, 4 and 6 as rewritten below:

1. (Amended) System for providing wireless point-to-multipoint connections having an access point using full-duplex mode and terminals using half-duplex mode, **characterized** in that

- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals using same downlink carrier, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

3.(Amended) Access point of a point-to-multipoint wireless link system, **characterized** in that

- the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals using same downlink carrier, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

4. (Amended) Terminal of a point-to-multipoint wireless link system, which terminal has an equipment identifier, **characterized** in that

the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule, and the terminal is arranged to receive a first broadcast message if it belongs to said first group and a second broadcast message if it belongs to said second group, wherein said first broadcast message and said second broadcast message are sent using same downlink carrier.

6. (Amended) Method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals, **characterized** in that

- the terminals are grouped into a first group and a second group,

- during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast message to terminals in the second group wherein said first broadcast message and said second broadcast message are sent using same downlink carrier, and

- at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message.

REMARKS

In accordance with 37 C.F.R. §1.121 (as amended on 11/7/2000) the rewritten claim(s) above are shown on

separate page(s) marked up to show all the changes relative to the previous version of that section.

Respectfully submitted,

29March02

Clarence A. Green Reg. No.: 24,622
PERMAN & GREEN, LLP
425 Post Road, Fairfield, CT 06430
(203) 259-1800
Customer No.: 2512

Date

Application entitled: A RADIO LINK SYSTEM

MARKED UP CLAIMS:

1. (Amended) System for providing wireless point-to-multipoint connections having an access point using full-duplex mode and terminals using half-duplex mode, **characterized** in that

- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals~~,~~ using same downlink carrier, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

3. (Amended) Access point of a point-to-multipoint wireless link system, **characterized** in that

- the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals using same downlink carrier, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

4. (Amended) Terminal of a point-to-multipoint wireless link system, which terminal has an equipment identifier, **characterized** in that

the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule~~.~~, and the terminal is arranged to receive a first broadcast message if it belongs to said first group and a second broadcast message if it belongs to said second group, wherein said first broadcast message and said second broadcast message are sent using same downlink carrier.

6. (Amended) Method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals, **characterized** in that

- the terminals are grouped into a first group and a second group,

- during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast message to terminals in the second group- wherein said first broadcast message and said second broadcast message are sent using same downlink carrier, and

- at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message.

A radio link system

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to microwave radio link systems, especially to such systems as described in the preamble of claim 1.

2. Description of Related Art

The invention concerns point-to-multipoint (PMP) radio systems, in which the access points (AP) operate in full-duplex mode and terminals (Access Terminal, AT) operate in half-duplex mode. Figure 1 illustrates the structure of such a system. Figure 1 shows terminals 10, an access point 20, and a telecommunications network 30. Typically such systems are used to provide fixed wireless connections between a central station i.e. an access point 20 (AP) and several fixed substations i.e. access terminals 10 (AT). Such systems are very advantageous in environments, where provision of fixed lines would cause prohibitive costs, such as in cities. Typically such systems are used to link base stations of a cellular telecommunications network to a central station 20, which is connected to rest of the telecommunications network 30. Such systems are also often used for providing wireless local area networks (WLAN). Such systems are also often used to provide connections between public networks and private business and residential customers.

In many cases such systems use time division to separate signals of the terminals from each other, i.e. they are arranged to transmit at different times. For simplicity and reasons of cost, terminals typically operate in half-duplex mode, i.e. the terminals cannot transmit and receive at the same time. The access points are typically capable of full-duplex operation. The number of access points in a network is considerably lower than the number of terminals, whereby the requirements for low cost are not as stringent as in the case of terminals and the structure of access points can be more complicated.

One example of such a system is the HIPERACCESS and HIPERLAN systems specified by the European Telecommunications Standards Institute. The HIPERACCESS system is described in detail in the ETSI specification

DTR/BRAN-010001 "Broadband Radio Access Networks (BRAN): Requirements and architectures for HIPERACCESS fixed networks".

According to current ETSI Bran Hiperlan/2 (HL2) draft specifications each terminal has to listen to a broadcast message (BM) at regular intervals, once in a constant length frame. Half-duplex terminals cannot send during that time even though the AP is always able to receive, since the AP operates in full duplex mode. Thus the uplink channel is idle during that time and radio interface capacity is wasted.

SUMMARY OF THE INVENTION

An object of the invention is to realize a PMP radio link system, which avoids the problems of prior art. A further object of the invention is to realize a PMP radio link system, which is able to use the capacity of the radio interface better than systems according to prior art.

The objects are reached by arranging the terminals into two groups, arranging a first group of the two groups to listen during a first half of a time period, arranging the second group of the two groups to listen during the second half of the time period, and sending broadcast messages twice i.e. once during said first half of the time period and once during said second half of the time period.

The system according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a system. The access point according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a access point. The terminal according to the invention is characterized by that, which is specified in the characterizing part of the independent claim directed to a terminal. The method according to the invention is characterized by that, which is specified in the characterizing part of the independent method claim. The dependent claims describe further advantageous embodiments of the invention.

According to the invention, the terminals are grouped into two groups. A first group of the two groups is arranged to listen during a first half of a time period and a second group of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice i.e. once during said first half of the time period and once during said second half of the time period, whereby all

terminals are able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

The broadcast messages transmitted by the access point comprise various control information, such as for example the identifier of the access point, identifier of the network operator, and identifier of the transmission sector. The broadcast messages may also comprise other types of information such as information about an access time slot, during which new terminals may initiate communication with the access point. The broadcast messages also indicate the reception periods of individual terminals. Consequently, the two broadcast messages have some parts in common, while terminal-specific parts are naturally different in the two broadcast messages of a frame.

Typically, the access point specifies the transmission periods allocated for a terminal in an individual transmission to the terminal, along with other terminal specific control information and possibly payload data. A terminal does not need to receive during other times as the broadcast message times and reception times indicated by the AP. During the other times, a terminal may transmit if transmission is allowed by the AP, or the terminal may be in idle mode in order to save power.

Each terminal advances the granted time values by the double propagation delay given by AP, so that the transmission of the terminal arrives at the access point at the indicated time, and conversely for reception.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail in the following with reference to the accompanying drawings, of which

Figure 1 illustrates a PMP system according to prior art, and

Figure 2 illustrates timing according to an advantageous embodiment of the invention.

Figure 3 illustrates timing according to a further advantageous embodiment of the invention,

Same reference numerals are used for similar entities in the figures.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A. A FIRST GROUP OF ADVANTAGEOUS EMBODIMENTS

In the following, an advantageous embodiment of the invention is described with reference to figure 2. Figure 2 illustrates the timing of listening and transmission times of various parties of a PMP system, i.e. the timing of a first group GROUP A, a second group GROUP B and an access point AP. White rectangles denote listening times, hatched rectangles denote time when a party may transmit and dotted rectangles denote actual transmission. Time T_0 denotes the beginning of a frame and time T_1 denotes the end of that frame and the beginning of the second frame. Time T_2 denotes the middle of the frame. According to the present advantageous embodiment of the invention, terminals in the first group GROUP A listen during the time period T_0 to T_2, and may transmit in the time period T_2 to T_1. Terminals in the second group GROUP B may transmit during the time period T_0 to T_2, and they listen in the time period T_2 to T_1. The access point transmits a broadcast message during the interval between times T_3 and T_4, which are both between times T_0 and T_2. The terminals in the first group GROUP A receive the message during that time, while terminals in the second group GROUP B may transmit during that time. At time T_2, terminals in the second group GROUP B begin to listen, and the access point transmits the second broadcast message during the interval between times T_5 and T_6, which are both between times T_2 and T_1. The terminals in the second group GROUP B receive the message during that time, while terminals in the first group GROUP A may transmit during that time.

In one advantageous embodiment of the invention, the broadcast messages are sent in the beginning of the frame and in the middle of the frame, i.e. times T_0 and T_3 are the same and T_2 and T_5 are the same.

B. A SECOND GROUP OF ADVANTAGEOUS EMBODIMENTS

In the following, a further advantageous embodiment of the invention is described with reference to figure 3. Figure 3 illustrates the timing of listening and transmission times of various parties of a PMP system, i.e. the timing of a first group GROUP A, a second group GROUP B and an access point AP. White rectangles denote listening times, hatched rectangles denote time when a party may transmit and dotted rectangles denote actual transmission. Time T_0 denotes the

beginning of a frame and time T_1 denotes the end of that frame and the beginning of the second frame. The first broadcast message is transmitted during the interval between times T_3 and T_4, and the second broadcast message during the interval between times T_5 and T_6. According to the present advantageous embodiment of the invention, terminals in the first group GROUP A listen during the time period T_3 to T_4, and may transmit during other times. Terminals in the second group GROUP B listen during the time period T_5 and T_6, and may transmit during other times.

In a further advantageous embodiment of the invention, the broadcast messages are sent in the beginning of the frame and in the middle of the frame, i.e. times T_0 and T_3 are the same and T_2 and T_5 are the same.

The two broadcast messages preferably comprise an identifier indicating which of the two broadcast messages a particular broadcast message is. Such an identifier allows terminals to recognize if a particular broadcast message is directed to the group it belongs to or to the other group. The identifier can be for example in the form of a bit pattern in the beginning of the broadcast message.

The allocation of actual transmission turns for the terminals for the time periods when the terminals may transmit can be performed in many ways. One advantageous method for allocating the transmission turns is described later in this specification.

According to an advantageous embodiment of the invention, the grouping of terminals to two groups is performed without any signalling from the access point. The grouping can advantageously be based on a device dependent parameter such as a device serial number or some other equipment identifier, more specifically on the value of the least significant bit of such an identifier. The terminal therefore knows which group it belongs to without any explicit signalling from the access point. This arrangement ensures, that almost any set of terminals can be grouped into two groups of roughly equal size.

According to a further advantageous embodiment of the invention, the access point can instruct one or more terminals to switch groups, if the sizes of the groups are too unequal.

C. A THIRD GROUP OF ADVANTAGEOUS EMBODIMENTS

Access point manages transmission timing of the terminals according to certain rules such that uplink capacity can be in full use. In the following, one example of such rules according to an advantageous embodiment is described.

The access point grants permissions to terminals to send uplink data based on transmission requests it has received from the terminals. The AP calculates and organizes the time slots so that each terminal does not need to receive downlink data and send uplink data simultaneously, thus allowing half-duplex operation for the terminals. When performing uplink time slot calculation, the AP preferably takes into account the downlink propagation times from AP to each AT and uplink propagation times from each AT to the AP.

At first the access point (AP) allocates the total available frame periods in near future to terminals (AT) by calculating the amounts of time each terminal will be granted in downlink and uplink. The access point (AP) knows how much transmission capacity each terminal needs, since the access point knows the connection types of the terminals. For obtaining this information for packet connections, the access point can periodically poll the terminals. Also, the terminals can indicate to the access point that they have data waiting to be transmitted. For example, the access point can periodically arrange a time slot for that purpose, during which any terminal having data waiting to be transmitted can send such an indication. After calculating the amounts of time needed by the terminals, the scheduler allocates exact time slots for the reception and transmission times of the terminals using a certain set of rules and trying to fulfill the amounts of time needed by the terminals and the requirements of the rules in an as optimal way as possible. One set of such rules according to an advantageous embodiment of the invention is described in the following. It is specifically noted here that the following is an example only, and other sets of rules for determining the transmission and reception times for the terminals could be used.

Only those terminals who need transmission or reception capacity are considered. Terminals are ordered according to the distance i.e. the time delay of the terminal from the access point. The transmission/reception time slot of the terminal of the first group (group A) which is closest to the access point is here denoted A_1, and that of the one furthest from the access point A_n. Similarly, the transmission/reception time slots of terminals of the second group (group B) are

denoted from B_1 to B_n according to the distance of the terminal from the access point. The distance i.e. the time delay of the terminals from the access point is known by the access point, since during the phase when a new terminal initiates communications with the access point. the access point adjusts the timing of the terminals so that the transmissions of the terminal arrive at the access point at the desired times. Therefore, both the access point and the terminal know the time delay caused by the propagation of the radio signal from the terminal to the access point or vice versa.

The broadcast message directed to terminals of the first group is denoted BM_A in the following, and the broadcast message to terminals of the second group is denoted BM_B.

In the downlink transmission, the access point aims to transmit BM_A in the beginning of the frame and BM_B in the middle of the frame. The position of BM_B within a frame is not very critical. However, it is very advantageous if successive first broadcast messages BM_A are repeated with a period of one frame period, and the second broadcast messages BM_B as well with a period of one frame period, which allows the terminals to adjust exactly to their respective broadcast message timing without having to listen and wait for a broadcast message to occur.

If the same capacity is needed for group A terminals as for group B terminals, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_n, BM_B, A_1, \ldots, A_n \qquad (1)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B, whereafter the second broadcast message BM_B is transmitted, followed by transmissions directed to individual terminals in group A.

In the case that the terminals in group B need to receive longer than terminals in group A, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_k, BM_B, B_{k+1}, \ldots, B_n, A_1, \ldots, A_n \qquad (2)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B. The second broadcast

message BM_B is transmitted in or as closely after the middle of the frame as possible, followed first by those transmissions to terminals in group B which did not fit in the frame between the two broadcast messages. The frame is finished by transmissions directed to individual terminals in group A.

In the case that the terminals in group B need to receive for a shorter time than terminals in group A, the transmissions of the AP are organized as follows:

$$BM_A, B_1, \ldots, B_n, A_1, \ldots, A_k, BM_B, A_{k+1}, \ldots, A_n \qquad (3)$$

That is, the first broadcast message BM_A is transmitted first, followed by transmissions directed to individual terminals in group B. After these, transmissions to terminals in group A are started, and the second broadcast message BM_B is transmitted in or as closely after the middle of the frame as possible. The frame is finished by transmissions to those terminals in group A, whose transmissions did not fit in the first half of the frame.

Since the terminals need to be instructed when to receive data, a terminal cannot receive data before it has been instructed about the correct time. Consequently, in the previous schemes, the reception times for at least those terminals of the B group whose reception times are before the BM_B of the current frame, have been specified in the BM_B of the previous frame, and preferably the reception times of the rest (if any) of B terminals as well. The broadcast messages may specify reception and transmission times for a longer time span than one frame.

The previous schemes (1), (2) and (3) have the advantage, that a terminal does not need to receive directly after reception of a broadcast message informing the terminal about its reception time. Without such an arrangement, an idle period may need to be used after a broadcast message, since the interpretation of the contents of a broadcast frame does not happen instantaneously due to the processing time needed to decode a broadcast message, which are typically encoded in various ways in order to enable error correction. However, in the previous schemes (1), (2) and (3) the terminal to which the transmission after a broadcast message is directed is able to receive the transmission, since the broadcast message is directed to terminals of the other group. For example, after BM_A, terminal B_1 is able to receive data at once, since that terminal is not busy decoding BM_A.

For the transmissions, the access point takes into account a guard period, which is required between the reception and transmission periods of a terminal in order to allow the terminal to change between transmission and reception operating modes. When performing the allocation, the access point adjusts the transmission and reception times so that none of the terminals is required to send within the guard period after or before a reception period of the particular terminal.

In the uplink direction, the closest terminal of group A is allowed to send after the guard period after the end BM_A, whereafter transmission periods are granted to other terminals in group A in order of distance, i.e. the second closest terminal next and so on. After the A terminals, transmission periods are granted to terminals in group B similarly in order of distance.

D. FURTHER ADVANTAGEOUS EMBODIMENTS OF THE INVENTION

According to an advantageous embodiment of the invention, a system for providing wireless point-to-multipoint connections is provided. Said system comprises an access point using full-duplex mode and terminals using half-duplex mode. In said system,

- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

In order to realize said functionality of classifying, sending and scheduling, said system preferably comprises means for classifying said terminals in said terminals, means in the access point for sending a first broadcast message and a second broadcast message to a first group of terminals and to a second group of terminals respectively, and means in the access point for scheduling transmission periods of terminals. Said means for classifying, sending and scheduling can advantageously be implemented using processors executing software program elements stored in a memory means in the particular system element.

According to a further advantageous embodiment, in said system the access point is arranged to schedule the transmission period of at least one terminal of said first group to overlap at least partly with the transmission period of said second broadcast message.

According to a still further advantageous embodiment of the invention, an access point of a point-to-multipoint wireless link system is provided. According to the embodiment, the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals, and the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

In order to realize said functionality of sending and scheduling, the access point preferably comprises means for sending a first broadcast message and a second broadcast message to a first group of terminals and to a second group of terminals respectively; and means for scheduling transmission periods of terminals. Said means for sending and scheduling can advantageously be implemented using a processor of the access point executing software program elements stored in a memory means in the access point.

According to another advantageous embodiment of the invention, a terminal of a point-to-multipoint wireless link system is provided, which terminal has an equipment identifier. According to the embodiment, the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule. In order to realize said functionality of classifying the terminal preferably comprises means for classifying the terminal. Said means for classifying can advantageously be implemented using a processor of the terminal executing software program elements stored in a memory means in the terminal. According to a further advantageous embodiment, the terminal is arranged to perform the classification based on the value of the least significant bit of the identifier.

According to a yet further advantageous embodiment of the invention, a method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals is provided. In the method, the terminals are grouped into a first group and a second group, during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast

message to terminals in the second group, and at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message. In a further advantageous embodiment, in said method at least one of the terminals of the first group is scheduled to transmit during at least a part of the transmission period of said second broadcast message.

E. FURTHER CONSIDERATIONS

The invention has several advantages. For example, the invention allows the elimination of idle time in the uplink direction during broadcast message transmissions in the downlink direction.

The invention has been described in the following as applied in the HIPERACCESS and HIPERLAN systems, but the invention is not limited to application in those systems. The invention can be used in any other PMP radio link systems, where a central station using full-duplex mode communicates with slave stations using half-duplex mode.

In view of the foregoing description it will be evident to a person skilled in the art that various modifications may be made within the scope of the invention. While a preferred embodiment of the invention has been described in detail, it should be apparent that many modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention.

Claims

1. System for providing wireless point-to-multipoint connections having an access point using full-duplex mode and terminals using half-duplex mode, **characterized** in that
- each of a plurality of the terminals has an equipment identifier,
- each of said plurality of the terminals is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on said equipment identifier according to a predefined rule; and
- the access point is arranged to send a first broadcast message to said first group of terminals and a second broadcast message to said second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

2. A system according to claim 1, **characterized** in that
- the access point is arranged to schedule the transmission period of at least one terminal of said first group to overlap at least partly with the transmission period of said second broadcast message.

3. Access point of a point-to-multipoint wireless link system, **characterized** in that
- the access point is arranged to send a first broadcast message in a frame to a first group of terminals and a second broadcast message in said frame to a second group of terminals, and
- the access point is arranged to schedule the transmission period of at least one terminal of said second group to overlap at least partly with the transmission period of said first broadcast message.

4. Terminal of a point-to-multipoint wireless link system, which terminal has an equipment identifier, **characterized** in that
the terminal is arranged to classify itself as belonging to a first group of terminals or a second group of terminals based on the equipment identifier according to a predefined rule.

5. The terminal according to claim 4, **characterized** in that
the terminal is arranged to perform the classification based on the value of the least significant bit of the identifier.

6. Method for providing wireless point-to-multipoint connections between an access point and a plurality of terminals, **characterized** in that
- the terminals are grouped into a first group and a second group,
- during a transmission frame, the access point sends a first broadcast message to terminals in the first group and a second broadcast message to terminals in the second group, and
- at least one of the terminals of the second group is scheduled to transmit during at least a part of the transmission period of said first broadcast message.

7. The method of claim 6, **characterized** in that
at least one of the terminals of the first group is scheduled to transmit during at least a part of the transmission period of said second broadcast message.

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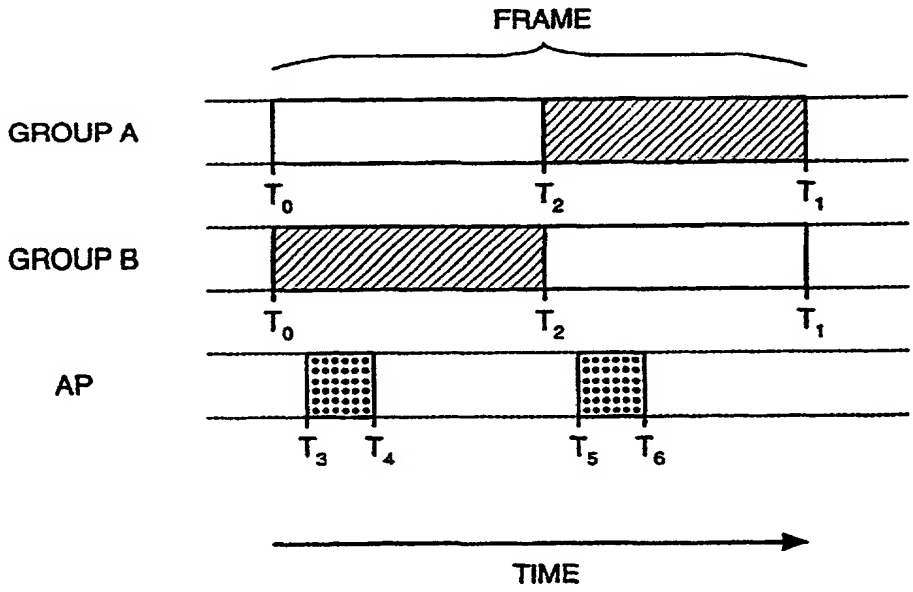

(57) Abstract: The invention is directed to microwave radio link systems. The invention concerns point-to-multipoint (PMP) radio systems, in which the access points (AP) operate in full-duplex mode and terminals (Access Terminal, AT) operate in half-duplex mode. According to the invention, the terminals are grouped into two groups. A first group of the two groups is arranged to listen during a first half of a time period and a second group of the two groups is arranged to listen during the second half of the time period. The broadcast messages are sent twice i.e. once during said first half of the time period and once during said second half of the time period, whereby all terminals are able to receive the broadcast messages, and half of the terminals are able to transmit at the time when the other half is receiving a broadcast message.

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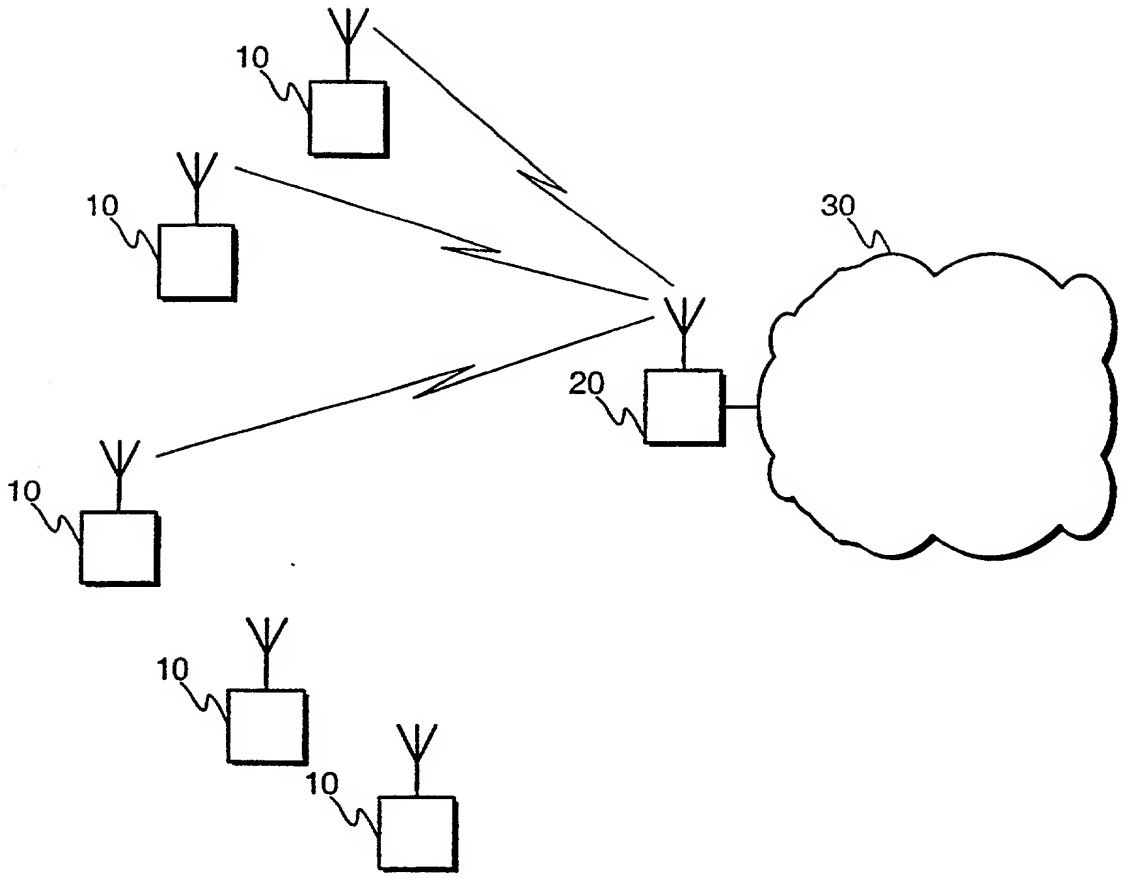

Fig. 1

PRIOR ART

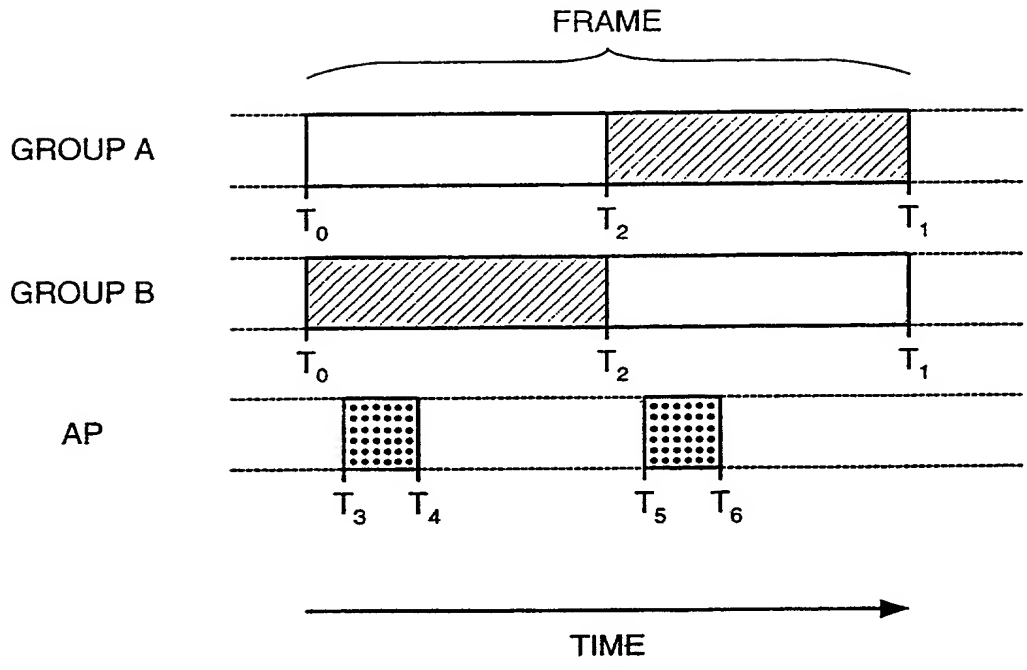

Fig. 2

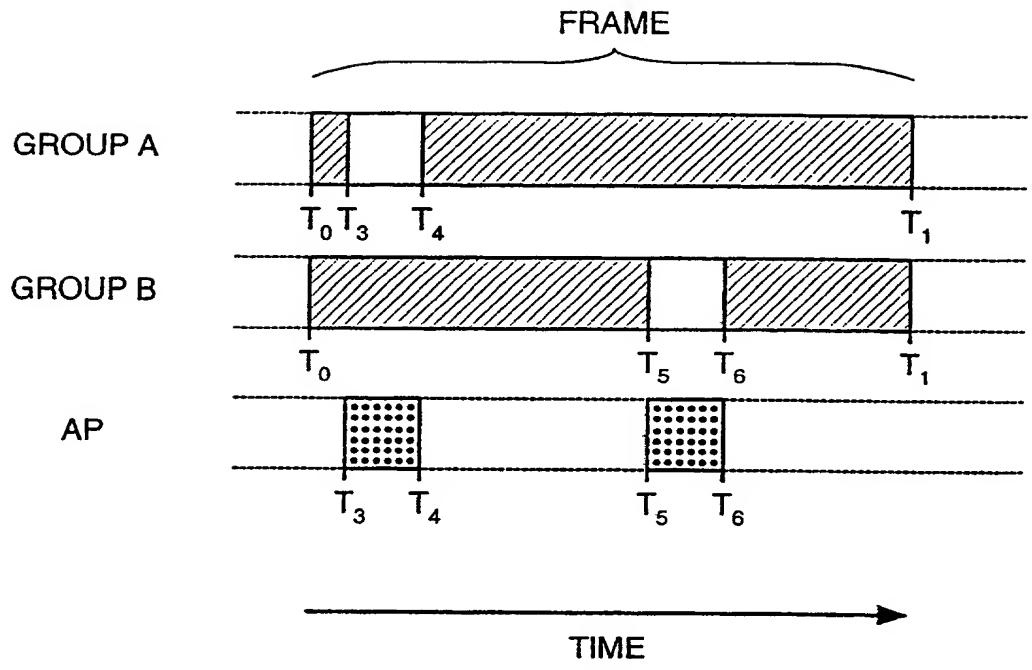

Fig. 3

Docket No.: 297-010894-US(PAR)

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: A RADIO LINK SYSTEM

the specification of which

(check one)

☐ is attached hereto.

x was filed on 2 October 2000 as PCT International Application Number PCT/FI00/00848 and was amended on (if applicable) _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International Application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

(Number)	(Country)	(Day/Month/Year Filed)	Priority Not Claimed
19992125	Finland	01.10.1999	☐
PCT/FI00/00848	PCT	02.10.2000	☐
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I hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International Application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International Application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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Full name of third inventor:
Third Inventor's signature: DATE
Residence address:
Citizenship.
Post Office Address.

Full name of fourth inventor:
Fourth inventor's signature: DATE
Residence address:
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